Direct healthcare cost of hospital admissions for chronic non-communicable diseases sensitive to primary care in the elderly

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Abstract *Aging has imposed changes in the epidemiological profile and an increase in the prevalence of chronic non-communicable diseases (CNCDs). The aim was to estimate the direct cost related to hospital admissions of elderly people affected by CNCDs (hypertension, heart failure and diabetes mellitus) sensitive to primary care, in a medium-sized hospital, in the period 2015-2019. Secondly, we investigated whether clinical and demographic factors explain the costs and length of stay. The medical records of 165 elderly people were analyzed. We found a predominance of women with a mean age of 76.9 years. The most frequent cause of hospitalization was heart failure (62%), and the average length of stay was 9.5 days, and 16% of hospitalizations corresponded to rehospitalizations. Of these, 81% were caused by complications from the previous hospitalization. The estimated total cost was R$ 3 million. Male patients had a longer hospital stay compared to female patients. Hypertension and the total number of procedures were significant predictors of cost and length of stay. We found that in 5 years, the costs of hospital admissions for conditions sensitive to primary care in the elderly are considerable, indicating the relevance of investments in primary care.*

Key words *Hospitalization, Primary Health Care, Costs and Cost Analysis, Noncommunicable Diseases, Aged*

Introduction

Currently, Brazil is in the process of demographic and epidemiological transition caused by the increase in the number of elderly people in relation to other age groups[1,2]. This process causes the phenomenon of population aging and, consequently, is associated with a higher prevalence of chronic non-communicable diseases (CNCDs) compared to acute diseases[1]. According to data from the World Health Organization (WHO)[1], between 2015 and 2050 the proportion of the world's population over 60 years of age is expected to double.

At first, this phenomenon began in developed countries, such as France, which had approximately 150 years to prepare for an increase in its elderly population from 10% to 20%[1]. However, countries such as Brazil, China and India will have just over 20 years to make the necessary adaptations[1]. This difference is explained by the patterns of change in the sociodemographic and epidemiological profile that occur heterogeneously among various countries[1,2]. The decision-making of the authorities in light of the impacts of the population aging process has direct consequences on economic and social aspects and has represented a challenge for health and social protection systems, which need to adapt to the needs of this population profile[2].

In addition to population aging, it is worth noting that the prevalence of frail older adults will also increase[3]. Frailty is a clinical syndrome characterized by the decline in the functioning of several physiological systems, causing greater vulnerability to adverse events such as falls, hospitalization, and death[3,4]. In the study developed by Hammami *et al.*[5], the presence of polypharmacy, increased age, dependence to perform activities of daily living, dementia, and living in long-stay institutions for the elderly were associated with the presence of Frailty Syndrome. Thus, it is relevant to develop preventive strategies in order to avoid negative health outcomes[3,5].

Most hospitalizations of the elderly occur due to primary care sensitive conditions, many of which are characterized by the worsening of chronic non-communicable diseases[6]. According to Ministry of Health Ordinance No. 221 of 2008[7], the Brazilian list of Hospitalizations for Primary Care Sensitive Conditions (HPCSC) is a list of causes for hospitalization and diagnoses classified by the International Classification of Diseases (ICD-10) that should have been adequately monitored in primary care before reaching highly complex care. The HPCSC represents the effectiveness of the care provided in primary health care and contributes to the identification of demands of the population and evaluation of the appropriate use of medical and hospital resources, informing managers in the process of planning and evaluation of healthcare actions[7].

In relation to the elderly population, in 2008 hospitalizations for primary care sensitive conditions accounted for almost half of the causes of hospitalizations of this population in the state of Santa Catarina, Brazil[6]. The most prevalent conditions were heart failure, chronic obstructive pulmonary diseases, and cerebrovascular diseases[6]. Santos *et al.*[8] investigated the prevalence of CNCDs in hospitalizations for primary care sensitive conditions, and the findings showed that these conditions accounted for 43.9% of total hospitalizations. These results highlight the fact that, although CNCDs have a slow and long-lasting development profile, they can generate negative outcomes if they are not adequately monitored and controlled[9]. Among the CNCDs, the most prevalent conditions in the elderly population are hypertension, heart failure, and diabetes mellitus, and socioeconomic conditions and lifestyle directly influence their occurrence[9,10].

Specifically in relation to the state of São Paulo, the most populous in Brazil with approximately 47 million inhabitants, the State Health Department data[11] show that between 2000 and 2019, about 14.5% of the total hospitalizations within the Unified Health System were due to primary care sensitive conditions. Among all the conditions analyzed, heart failure was the condition with the highest hospitalization rate in the same period[11]. These data are relevant because a study by Rocha *et al.*[12], which used a database of the Portuguese health system, showed that the total cost associated with avoidable hospitalizations in the period of one year was € 250 million and 82% of these hospitalizations occurred in individuals aged 65 years or older. In a scenario in which financial resources are limited, it is essential to expand health gains and prevent spending to optimize the use of available resources[13]. Therefore, it is clear to see the importance of cost of disease assessments to inform the decision making of managers through careful studies that consider not only the clinical aspects, but also the economic aspects of a given health condition[14].

Considering the effects of population aging, the present study was developed in order to answer the following research question: What are the costs arising from hospitalizations for prima-

ry care sensitive CNCDs in elderly people treated in a medium-sized hospital in the 7th Regional Health Department (DRS VII - Campinas)? In this region, one of the most highly populated areas in the state of São Paulo, hospitalizations for primary care sensitive conditions corresponded to approximately 20% and 15% of total hospitalizations in the years 2000 and 2019, respectively[11]. Thus, this investigation can contribute to the understanding of the impact of these conditions, in addition to educating and guiding managers to plan actions in primary health care, as well as to direct actions to improve care processes in the hospital system.

Consequently, the aim of this study was to estimate the direct costs related to hospitalizations for primary care sensitive CNCDs (hypertension, heart failure, and diabetes mellitus) in elderly patients hospitalized in a medium-sized hospital in the 7th Regional Health Department (DRS VII - Campinas), located in the state of São Paulo, Brazil. A second objective was to investigate whether clinical and demographic factors explain the total cost and length of hospital stay of these patients.

Method

Research design

This is a cost-of-illness study, with a micro-costing approach (*bottom-up*), from the perspective of a medium-sized philanthropic hospital analyzing a period of 5 years (2015-2019). The hospital analyzed in this study is located in the countryside of the state of São Paulo, in a city with approximately 244 thousand inhabitants, and it is part of the 7th Regional Health Department (DRS - Campinas). The hospital has 111 beds that serve the clinical, surgical, pediatric, and obstetric units, as well as the neonatal, child, and adult intensive care units. In addition to high complexity care, the hospital also provides outpatient care for medical and multiprofessional specialties and has an imaging diagnostic test department.

Data sources

The study data were collected via consultation of electronic medical records of patients admitted to the hospital. The records were accessed via the local electronic hospital management system (SisHOSP), and the data were individually extracted from the electronic medical record by date of birth and service record number. The sources consulted were the general patient register for the sociodemographic data and the service invoicing records for the cost assessment.

Participants

Hospital admissions for primary care sensitive chronic diseases (systemic arterial hypertension, heart failure, and diabetes mellitus) in the elderly were selected for the period ranging from 2015 to 2019. The study was approved by the institution's Research Ethics Committee (protocol No. 9/2020, 12/30/2020).

The inclusion criteria were: 1) Hospital admissions between 2015 and 2019 having as their main ICD-10 code chronic diseases sensitive to primary care (systemic arterial hypertension - I10 and I11, heart failure - I50 and J81, and diabetes mellitus - E10 to E14); and 2) Elderly patients (60 years or more). The exclusion criteria were: 1) Patients who underwent changes in the description of the cause of hospitalization in the medical record, after diagnostic elucidation; 2) Patients hospitalized on an elective basis and not urgency/emergency.

Elective hospital admissions were excluded from the present study, considering that in many of these admissions the same ICDs were used as primary diagnoses, however, surgical procedures were performed that, in many cases, were unrelated to the main ICD investigated in the present study.

The study sample was collected using reports generated by the electronic management system of the investigated hospital. The selection was based on the period of interest according to the defined time horizon, the ICD of the primary reason for hospitalization, and the age group. After applying these criteria, the final sample was established as shown in Figure 1, totaling 165 hospitalizations for these conditions.

Analysis of procedures and costs

After data collection, the calculation of costs was carried out by analysis of the individual medical records. The analysis considered the direct sanitary costs related to the treatment and/or in-hospital rehabilitation during each patient's hospital stay.

The costs were divided into the following components: 1) Daily Rates and Fees: composed of the costs of the hospital's daily rate and expenses with food (breakfast, lunch, afternoon

snack, dinner, and supper); 2) Medication and Materials: composed of the costs of drugs and materials used to perform all procedures; 3) DTSS (Diagnostic and Treatment Support Service): composed of the healthcare costs of the multidisciplinary health team and the pathology test, imaging test, and procedures that the patient performed during the hospitalization period; 4) Medical Fees: composed of the cost of payment of the medical professionals who cared for the patients.

Based on the medical record number, the cost information was extracted from the investigated hospital's invoicing system. Sociodemographic data were also obtained and tabulated using the patient's medical record number.

All data extracted from the medical records were inserted into Microsoft Excel® and subsequently analyzed in the statistical program SPSS (Statistical Package for the Social Sciences) version 25.0. The unit costs of the resources were multiplied by the estimated quantity used and calculated in Brazilian Reais (R$). The values were adjusted for inflation based on 2019 figures, according to the National Consumer Price Index (IPCA).

Data analysis

Patients were characterized based on sociodemographic and socioeconomic data (sex, age, education, marital status, occupation [economic activity], and monthly income) extracted from the electronic medical record, when available. Clinical information, when available, was also used to characterize patients.

The extracted data were presented descriptively, according to the categories of procedures and actions, by absolute and relative frequency, and by mean and standard deviation. The amount of resource use and costs were presented by component, by the total sum of the categories, and by the average values per patient.

A generalized linear regression analysis with gamma distribution was performed. This model was adopted because it allows an analysis in which the response variables do not present a normal distribution. This model also allows inferences about the average costs. To define the predictor variables, initially the collinearity between variables was verified. The collinear variables ($r > 0.7$) were excluded.

Two regression models were performed. The first model considered as predictive variables of the total cost of hospitalization (response variable), the causes of hospitalization (Systemic Arterial Hypertension, Diabetes Mellitus, and
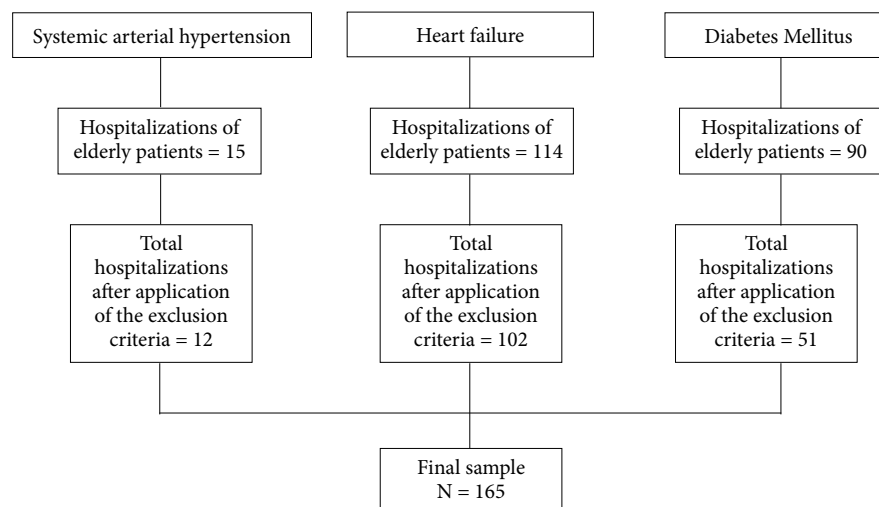

Figure 1. Flowchart of the screening process of the study sample.

Source: Authors.

Heart Failure), physical therapy intervention (Yes or No), total tests performed (quantity), age (in years), and total ICU daily rates. The second model considered the length of stay as a response variable, as well as the following predictors: causes of hospitalization (Systemic Arterial Hypertension, Diabetes Mellitus, and Heart Failure), physical therapy intervention (Yes or No), sex (male or female), and total number of tests performed (quantity).

A confidence interval of 95% (95%CI) with significance of 5% (p<0.05) and identity link function was adopted to estimate the model. The Akaike information criterion was used to verify the fit of the models, confirming the gamma distribution as more appropriate. The significance level was set to 5% (p<0.05).

The analysis of the uncertainty parameters of the cost components (in R$) were performed using the estimates of the 95%CI and standard error (SE) based on 1000 bootstrap samples and generation of a tornado chart.

Results

The sociodemographic data of the hospitalizations evaluated are shown in Table 1.

We found that, in relation to sex, there was a predominance of females (56%), with a mean age of 76.9 years. Most participants had white skin (91%). Regarding occupation and education, more than half of the medical records did not contain that information (51% and 55%, respectively). No data on individuals' monthly income were found.

Regarding the causes of hospitalization, the most prevalent condition was heart failure (62%). The mean length of hospital stay was 9.5 days (SD=16.1) and among the hospitalizations analyzed, there were 20 deaths. Considering the total number of hospitalizations, 27 of them corresponded to patients who had been hospitalized less than 30 days before the analyzed readmission. Of the readmissions, 81% (22 readmissions) were caused by complications from the previous hospitalization.

Table 2 shows the data regarding the cost of the analyzed hospitalizations, based on stratification by cause and by cost categories. The total cost of hospitalizations in the analyzed period was approximately R$ 3 million, with an average of R$ 18,217 per hospitalization (SE [standard error]: R$ 2,985). In addition, the average costs per hospitalization, considering the observed causes

(heart failure, diabetes, and hypertension, respectively) were R$ 18,602 (SE: R$ 3,438), R$ 14,114 (SE: R$ 4,281), and R$ 32,378 (SE: R$ 22,919).

The cause that presented the highest cost in the period investigated was heart failure, followed by diabetes mellitus and systemic arterial hypertension. We found that 2018 had the highest cost for hospitalizations due to these conditions. Considering the three conditions, the cost category that represented the highest percentage was the daily hospital rates and fees.

We verified that most of the procedures corresponded to laboratory tests, totaling 4,796 tests in the analyzed period, followed by physiotherapy interventions, with a total of 4,004 sessions. Subsequently, inhalations were performed 1,254 times, and there were 772 daily ICU rates.

Regarding the analysis of the uncertainty parameters of the cost components (in R$), we verified that for fees/daily rates, the mean value was R$ 13,528.2 with a standard error of R$ 2,090.2 (95%CI: 9,818.0; 17,968.7). Regarding professional fees, the mean values were R$ 2,494.2 with a standard error of R$ 563.2 (95%CI: 1,494.5; 3,699.5). Medication and materials and tests in the DTSS presented mean values of R$ 1,197.3 with a standard error of R$ 223.8 (95% CI: 798.2; 1,672.4), and R$ 997.5 with a standard error of R$ 146.2 (95%CI: 733.3; 1,307.3), respectively. The sensitivity analysis considering the variations of the cost components is illustrated in Figure 2. The amounts for the fees and daily rates were the components that most influenced the data.

Table 3 presents the data of the regression analysis considering the total cost (response variable). The regression indicated that the cause of hospitalization (systemic arterial hypertension), total tests performed, and daily ICU rates were significant predictors of the total cost. We found that patients hospitalized for systemic arterial hypertension had a higher average cost when compared to other conditions (approximately R$ 4,000). The model showed that with each ICU admission, and with each test performed, there was an increase in the total cost of approximately R$ 1,331 and R$ 164, respectively.

Table 4 presents the data of the regression analysis of length of hospital stay. In this analysis, we found that systemic arterial hypertension and the total number of tests requested were significant predictors of length of stay in the analyzed hospital. We also found that patients hospitalized for systemic arterial hypertension had a longer mean length of hospital stay when compared to hospitalizations for other conditions (approx-

Table 1. Characterization data of the participants (N=165), with presentation of sociodemographic data, prevalence of causes of hospitalization, length of stay, and discharge status (SD: Standard Deviation).

Sociodemographic data	
Sex (%)	
Female	56%
Male	44%
Age in years, mean (SD)	76.94 (9.90)
Skin Color (N %)	
White	150 (91)
Black	9 (5)
Brown	3 (2)
Not stated	3 (2)
Education (N %)	
Illiterate	9 (5)
Primary education	57 (35)
Secondary education	9 (5)
Not stated	90 (55)
Marital Status (N %)	
Single	14 (9)
Married	88 (53)
Divorced	6 (4)
Widowed	55 (33)
Cohabiting	2 (1)
Total children, mean (SD)	2.82 (2.49)
Occupation (N %)	
Retiree	71 (43)
Homemaker	2 (1)
Other occupations	8 (5)
Not stated	84 (51)
Causes (N %)	
Systemic arterial hypertension	12 (7)
Heart failure	102 (62)
Diabetes Mellitus	51 (31)
Length of stay (days), mean (SD)	10.26 (17.75)
Status (N %)	
Discharge	143 (87)
Death	20 (12)
Transfer	2 (1)
Readmission (N %)	
Yes	27 (16)
No	138 (84)

Source: Authors.

imately 3 days longer). The model also showed that each test performed increased the length of stay by approximately 0.13 days.

Discussion

The objective of this study was to estimate the direct costs related to hospitalizations of elderly individuals with chronic non-communicable diseases, in addition to investigating whether clinical and demographic factors explain the total cost and length of hospital stay. Our findings showed that the cost of hospitalizations in the elderly due to conditions that could be prevented in Primary Health Care was considerable, totaling approximately R$ 3 million in the analyzed hospital. The most prevalent cause of hospitalization was heart failure, representing more than half of the hospitalizations analyzed, and it was also the cause that generated the highest cost in the analyzed period (approximately R$ 2 million). Among all the observed causes, the "Daily Rates and Fees" was the component that most influenced the total cost. Systemic arterial hypertension (SAH) and the total number of tests performed were significant predictors of total cost and length of stay, and patients with SAH generated higher mean costs compared to patients hospitalized for other conditions, and they also had a longer mean length of hospital stay.

In our study, the majority of the individuals hospitalized due to the conditions investigated were women with a mean age of approximately 76 years. These findings were expected and corroborate the fact that population aging shows a greater number of women in relation to men[15]. In the study by Santos *et al.*[16], the results also indicated a higher prevalence of clinical hospitalizations among the female population. Historically, the female population has a lower mortality rate due mainly to gender and cultural factors, such as the practice of better life habits and health care and also greater demand for health services, when compared to males[16,17]. While women live longer with chronic non-communicable diseases, the mortality rate of men is caused mainly by circulatory diseases, diseases associated with lifestyle habits (such as smoking and alcoholism), and deaths from external causes[17]. Consequently, these factors also trigger a higher probability of women becoming widows and often in disadvantaged economic situations[17].

Regarding the income of the analyzed population, that information was not found in the medical records analyzed. This aspect is relevant, considering that the study by Laberge *et al.*[18] demonstrated that the risk of hospitalization for primary care sensitive conditions was lower in patients with the highest socioeconomic level. In

Table 2. Data referring to the total cost of hospitalizations in the analyzed hospital considering the causes and cost components, in the period from 2015 to 2019.

Condition	2015	2016	2017	2018	2019	Total 2015-2019
Systemic arterial hypertension						
Daily rates and fees	0.00	2,535.72	243,056.52	44,436.78	19,010.89	309,039.91
Medication and Materials	0.00	133.00	23,093.52	1,373.21	861.70	25,461.43
DTSS	0.00	50.24	12,622.46	3,138.48	2,541.85	18,353.03
Medical fees	0.00	120.31	28,605.79	3,677.83	3,285.00	35,688.93
Total Systemic Arterial Hypertension	0.00	2,839.28	307,378.30	52,626.30	25,699.44	388,543.32
Heart failure						
Daily rates and fees	116,149.82	184,571.96	211,394.27	521,124.21	356,120.08	1,389,360.34
Medication and Materials	8,760.80	17,691.00	19,561.41	43,094.28	31,713.72	120,821.21
DTSS	9,812.99	15,750.77	17,180.75	39,503.80	29,946.49	102,381.81
Medical fees	13,003.98	29,021.38	54,956.86	81,048.45	97,066.967	275,097.637
Total Heart Failure	147,727.59	247,035.10	303,093.29	684,770.74	514,847.26	1,897,473.98
Diabetes Mellitus						
Daily rates and fees	86,011.43	88,776.15	102,746.76	72,606.94	183,610.10	533,751.38
Medication and Materials	5,107.09	9,046.26	6,382.04	7,218.58	23,519.35	51,273.32
DTSS	4,932.18	1,878.28	10,427.64	3,089.08	13,704.77	34,031.95
Medical fees	8,656.06	8,729.45	9,644.56	4,908.52	68,819.23	100,757.82
Total Diabetes Mellitus	104,706.76	108,430.14	129,201.00	87,823.12	289,653.45	719,814.47
Overall total (R$)	252,434.36	358,304.53	739,672.60	825,220.16	830,200.15	3,005,831.80

Source: Authors.
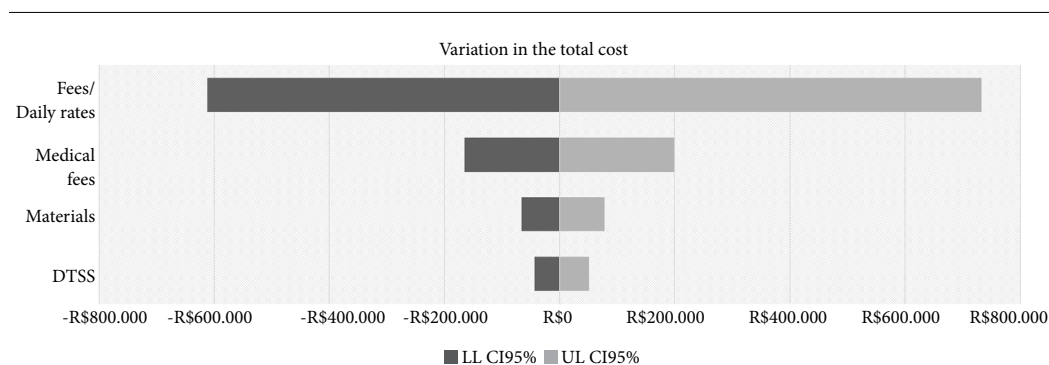
Figure 2. Sensitivity analysis considering the cost components and the variation of the total cost of hospitalization of elderly people with chronic non-communicable diseases in the analyzed hospital (LL: Lower limit of the 95% confidence interval; UL: Upper limit of the 95% confidence interval).

Source: Authors.

the study by Kangovi et al.[19], the intervention by programs in Primary Health Care caused a reduction in hospitalizations, in hospital readmissions after less than 30 days, and in the mean length of hospital stay in low-income patients. Thus, it is important to collect these data to detect risk groups assisted by health institutions, in order to develop specific and effective actions within the health system. In the research conducted by Silveira et al.[20], the expenses with hospitalizations of elderly patients correspond to a significantly higher value than the expenses with adults and children. In addition, in the study by McDarby and Smyth[21], hospitalizations due to primary care

Table 3. Data from the regression analysis of the total cost of hospitalization.

Total Cost (R$)	B (SE)	95%CI	p
Intercept	-244.68 (1237.65)	-2670.44; 2181.07	-
Cause			
Systemic Arterial Hypertension	4070.69 (558.28)	2676.48; 5164.91	<0.001
Diabetes Mellitus	-12.56 (551.47)	-1093.12; 1068.61	0.98
Heart failure‡	-	-	-
Received Physical Therapy			
Yes	-419.41 (375.50)	-1155.36; 316.53	0.26
No‡	-	-	-
Total Tests	164.25 (18.87)	127.29; 201.22	<0.001
Age	20.59 (15.41)	-9.61; 50.79	0.18
ICU Daily Rates	1331.06 (206.36)	926.59; 1735.51	<0.001

B: Parameter estimate based on identity link (in R$); SE: Standard error; CI: Confidence interval; ‡Reference variables in the regression model.

Source: Authors.

Table 4. Data from the regression analysis of length of hospital stay.

Length of stay (days)	B (SE)	95%CI	p
Intercept	2.21 (0.46)	1.30; 3.13	-
Cause			
Systemic Arterial Hypertension	3.21 (0.84)	1.57; 4.85	<0.001
Diabetes Mellitus	-0.26 (1.23)	-2.15; 2.67	0.83
Heart failure‡	-	-	-
Received Physical Therapy			
Yes	-0.68 (0.59)	-1.83; 0.47	0.24
No‡	-	-	-
Sex			
Female	0.61 (0.54)	-1.66; 0.45	0.26
Male‡	-	-	-
Total Tests	0.13 (0.02)	0.09; 0.17	<0.001

B: Parameter estimate based on identity link (in days); SE: Standard error; CI: Confidence interval; ‡ Reference variables in the regression model.

Source: Authors.

sensitive conditions accounted for almost 20% of total hospitalizations in 2016, which points to the need to prioritize investments in comprehensive and preventive care programs in the low and medium complexity spheres of health care, as a way to avoid expenses for the system.

The study by Oksuzyan et al.[22] points to a projection in which the population aged over 70 years will increase their use of hospital care. This population represented 37.5% of all days used in the year 2013 and, by 2050, this will increase to 56.2%[22]. These findings demonstrate that, in addition to having a heavy financial impact on the health system, hospitalizations of elderly patients also have direct consequences on the health of the individual and negatively impact both their functionality and quality of life, as well as that of their caregivers[23]. Alternatively, in the study by Dunn et al.[24], investment in home care programs with incentives to self-care generated a direct reduction in costs with hospitalizations. In addition, it is important that these patients receive an adequate discharge plan identifying the needs after discharge to access the supports that will be necessary, thus avoiding hospital readmissions after a short period of time[23].

We found that the most prevalent cause of hospitalization was heart failure, followed by diabetes mellitus, and systemic arterial hypertension. These findings are corroborated by the study by Kardas and Ratajczyk-Pakalska[25], which showed that the most prevalent cause of hospitalizations in the elderly was cardiovascular disease. In the research conducted by Hertz et al.[26], with a sample of the African population, approximately 32% of patients hospitalized for heart failure who also had a previous diagnosis of HIV had hypertensive complications. As we did not collect information about the presence or absence of this previous condition, we cannot assume whether hospitalizations due to heart failure were associated with a hypertension crisis. In the systematic review conducted by Lesyuk et al.[27], the results showed that the costs of hospitalizations for heart failure were high and tended to increase over time. In addition to being a prevalent cause of hospitalization, it is also a strong predictor of mortality in patients with this condition[28,29]. Moreover, readmission rates represent approximately 30% of total discharges and usually occur between 60 and 90 days after the first hospital discharge[29]. In our study, we analyzed the readmission rate in all conditions considering a readmission to be a new admission less than 30 days after the previous hospital discharge, and 16% of all cases analyzed were the result of readmissions.

Regarding the procedures performed, most of them corresponded to laboratory tests, followed by physiotherapy interventions and inhalations. Especially when it comes to elderly patients, the duration of bed rest can result in decreased muscle mass and, consequently, functional loss, inability to perform activities of daily living after discharge, greater propensity for falls, increased frailty, and immobility[30]. Thus, in this scenario, it is important to prepare an individual Care Plan that aims to meet the specific needs of each patient, including physiotherapy interventions in the musculoskeletal system, which are fundamental to the rehabilitation process and activity demands of these patients[30,31].

In our study, SAH was a significant predictor of the total cost of hospitalizations. In the study by Wagner et al.[32], the cost of hospitalizations for arterial hypertension was also high. In addition, hospitalizations for this condition also proved to be impacting on primary care sensitive hospitalizations[33]. These findings emphasize the importance of preventive and specialized care for these health conditions, as a way to generate benefits for patients and reduce expenses for the system[33].

In addition, in relation to length of stay, SAH was also a predictor for increased length of hospital stay. In the study by Amegbor et al.[34], elderly individuals with cardiovascular conditions were at higher risk of longer hospital stays, specifically those with hypertension. Furthermore, patients with lower income were also more likely to have a long stay.[34] This finding highlights the importance of collecting data on the socioeconomic status of the individual at the time of hospitalization as a way to anticipate the risk of long stay of these patients.

Regarding the use of ICU beds, we found a total of 772 daily rates, which were significant predictors of the total cost. In the study by Karabatsou et al.[35], the cause of admission, mechanical ventilation, and the need for dialysis were factors associated with the increased cost of hospitalization in these units. Thus, the cost of ICU varies according to the needs of each patient and can be influenced by several factors[35]. The estimation of this cost proves to be a relevant factor in understanding the costs and directing effective actions in health[35]. In relation to the use of these beds by elderly patients, most admissions are for frail elderly patients and this condition is strongly associated with unfavorable outcomes[36,37].

In the study by Oliveira et al.[38], the mean cost of hospitalization in the elderly was higher in relation to the mean cost for the other age groups. In the same study, the mean cost of hospitalizations for patients between 60 and 79 years of age was approximately R$ 4,000 and for patients aged 80 years or more, it was approximately R$ 2,700[38]. In our study, the total cost of the interactions analyzed in the five-year period was approximately R$ 3 million and the average cost per hospitalization was R$ 18,217, demonstrating that the observed costs were considerable compared to the literature.

Our results can contribute to the identification of the need for greater investment in primary and outpatient care as a way to reduce costs with high complexity care. They also highlight the need for an adequate care pathway to avoid problems related to hospitalization. In the review conducted by Chinnappa-Quinn et al.[39], in addition to having negative consequences on the activities of daily living of elderly patients, hospitalization was also associated with increased cognitive decline, which can generate negative consequences for the quality of life of this population. Harrison et al.[40] demonstrated that the investment of resources in primary health care positively impacted the reduction in hospital

admissions. Specifically in relation to heart failure, hospitalizations for this condition were significantly reduced with health promotion and prevention programs that also include telephone monitoring[41]. Although these hospitalizations result in expenses that could have been avoided for the system, these events also have negative consequences for the elderly, such as the loss of functional capacity that may occur during and after hospitalization, directly impacting their quality of life and may generate a gradual growth of dependence on hospital care[42].

Based on our data, we emphasize the importance of health management and greater investments in primary health care, in order to avoid hospitalizations due to the worsening of preventable conditions. In addition, our findings raise a relevant discussion about avoidable expenses that could have been invested in other areas in order to optimize health care and prevent hospitalization for primary care sensitive conditions.

Conclusion

We found that in a period of five years, the costs of hospitalizations for primary care sensitive conditions in the elderly were considerable in the analyzed hospital. The most prevalent cause of hospitalization was heart failure, which was also the cause that generated the highest cost in the analyzed period. Patients with SAH had a higher mean cost and length of stay when compared to patients hospitalized due to other conditions. Our results point to the importance of investments in Primary Health Care focusing on the treatment of chronic non-communicable diseases as a way to avoid hospitalizations due to the worsening of conditions that could have been prevented and, in addition, highlight the importance of providing better care and quality of life for this population.

Collaborations

Acknowledgements

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